CLAIMS

Claims 6-54 remain in the application. Claims 6, 8, 10, 18, 24, 29, 31, and 39 have been amended. No claims have been cancelled or added.

Listing of Claims:

1 – 5. (Canceled).

6. (Currently Amended) A network device comprising:

at least one processor;

memory;

I/O; and

at least one virtual router in the memory, said at least one virtual router including a network interface, wherein the at least one virtual router is associated to an unique network domain, the at least one virtual router forwards data within the unique network domain and the at least one virtual router is one of a plurality of virtual routers in the memory;

a sub-interface data structure in the memory; and

a binding data structure in the memory which binds the network interface to the sub-interface data structure.

7. (Presently Amended) The network device of claim 6 wherein,

the network interface is a layer 3 network interface;

the sub-interface data structure is a layer 2 interface data structure; and

the binding data structure is layer 2/3 binding structure which binds the layer 3 network interface to the layer 2 interface data structure.

8. (Currently Amended) An electronic memory encoded with:

at least one virtual router, said at least one virtual router including a network interface, where the at least one virtual router is associated to an unique network domain, the at least one virtual router forwards data within the unique network domain and the at least one virtual router is one of a plurality of virtual routers in the memory;

a sub-interface data structure; and

a binding data structure which binds the network interface to the sub-interface data structure.

9. (Presently Amended) The electronic memory of claim 8 wherein:

the network interface is a layer 3 network interface;

the sub-interface data structure is a layer 2 interface data structure; and

the binding data structure is a layer 2/3 binding data structure which binds the layer 3 interface to the layer 2 interface data structure.

10. (Currently Amended) A method of creating a link in at least one network domain comprising:

providing a network device including an electronic memory encoded with at least one virtual router which includes at least one network interface, wherein the at least one virtual router is associated to an unique network domain, the at least one virtual router forwards data within the unique network domain and the at least one virtual router is one of a plurality of virtual routers in the memory;

providing at least one sub-interface data structure encoded in the electronic memory; and

binding the at least one network interface to the at least one sub-interface data structure.

11. (Original) The method of claim 10 wherein binding includes creating a binding data structure that binds the at least one network interface to the at least one sub-interface data structure.

12. (Original) The method of claim 10 further comprising:

providing at least one other network interface encoded in the electronic memory; and

binding the at least one other network interface to the at least one sub-interface data structure.

13. (Original) The method of claim 12 further including:

eliminating the binding of the at least one network interface to the at least one sub-interface data structure.

14. (Original) The method of claim 10 further comprising:

providing at least one other sub-interface data structure encoded in the electronic memory; and

binding the at least one network interface to the at least one other sub-interface data structure.

15. (Original) The method of claim 14 further including:

eliminating the binding of the at least one network interface to the at least one sub-interface data structure.

16. (Original) The method of claim 10,

wherein binding the at least one network interface to the at least one sub-interface data structure includes creating a binding data structure that binds the at least one network interface to the at least one sub-interface data structure; and further including:

providing at least one other network interface encoded in the electronic memory;

binding the at least one other network interface to the at least one sub-interface data structure;

wherein binding the at least one other network interface to the at least one sub-interface data structure includes creating a binding data structure that binds the at least one other network interface to the at least one sub-interface data structure; and

eliminating the binding of the at least one network interface to the at least one sub-interface data structure while leaving the at least one network interface intact.

17. (Original) The method of claim 10,

wherein binding the at least one network interface to the at least one sub-interface data structure includes creating a binding data structure that binds the at least one network interface to the at least one sub-interface data structure; and further including:

providing at least one other network interface encoded in the electronic memory;

providing the at least one other sub-interface data structure encoded in electronic memory;

binding the at least one other network interface to the at least one other sub-interface data structure;

wherein binding the at least one network interface to the at least one other sub-interface data structure includes creating a binding data structure that binds the at least one network interface to the at least one other sub-interface data structure;

binding the at least one other network interface to the at least one other sub-interface data structure;

wherein binding the at least one other network interface to the at least one other sub-interface data structure includes creating a binding data structure that binds the at least one other network interface to the at least one other sub-interface data structure;

eliminating the binding of the at least one network interface to the at least one sub-interface data structure while leaving the at least one network interface intact.

18. (Currently Amended) A method of creating a link in a network domain comprising:

providing a network device including an electronic memory encoded with a first virtual router which includes at least one first network interface and with a second virtual router which includes at least one second network interface, wherein the first virtual router is coupled to a first network domain, and the second virtual router is coupled to a second network domain;

providing at least one first sub-interface data structure encoded in the electronic memory;

providing at least one second sub-interface data structure encoded in the electronic memory;

binding the at least one first network interface to the at least one first sub-interface data structure, wherein the first virtual router forwards data within the first network domain through the first network interface; and

binding the at least one second network interface to the at least one second sub-interface data structure, wherein the second virtual router forwards data within the second network domain through the second network interface.

19. (Original) The method of claim 18 wherein,

binding the at least one first network interface to the at least one first sub-interface data structure includes creating a first binding data structure; and

binding the at least one second network interface to the at least one second sub-interface data structure includes creating a second binding data structure.

20 (Original) The method of claim 18 further including:

binding the at least one second network interface to the at least one first sub-interface data structure; and

eliminating the binding of the at least one second network interface to the at least one second sub-interface data structure.

21. (Previously Presented) The method of claim 18 further including:

providing respective first and second network databases associated with the respective first and second virtual routers wherein such respective first and second databases include one or more types of control information used to manage or monitor operations, selected from the group consisting of: network (layer 3) addressing, layer 3

connections, routing, routing protocols, route filters and policies, tunneling, tunneling protocols.

22. (Previously Presented) The method of claim 18 further including:

providing respective first and second network databases associated with the respective first and second virtual routers wherein such respective first and second databases include control information used to manage or monitor operations, selected from the group consisting of: network (layer 3) addressing, layer 3 connections, routing, routing protocols, route filters and policies, tunneling, tunneling protocols;

binding the at least one first network interface to the at least one first sub-interface data structure includes creating a first binding data structure; and

binding the at least one second network interface to the at least one second sub-interface data structure includes creating a second binding data structure.

23. (Previously Presented) The method of claim 18 further including:

providing respective first and second network databases associated with the respective first and second virtual routers wherein such respective first and second databases include one or more types of control information used to manage or monitor operations, selected from the group consisting of: network (layer 3) addressing, layer 3 connections, routing, routing protocols, route filters and policies, tunneling, tunneling protocols;

binding the at least one first network interface to the at least one first sub-interface data structure includes creating a first binding data structure;

binding the at least one second network interface to the at least one second sub-interface data structure includes creating a second binding data structure;

binding the at least one second network interface to at least one first sub-interface data structure; and

eliminating the binding of the at least one second network interface to the at least one second sub-interface data structure.

24. (Currently Amended) A method of creating links between multiple subscriber end stations and multiple network domains comprising:

providing a network device including an electronic memory encoded with multiple respective virtual routers, each of said respective virtual routers including a separate respective ~~corresponding~~ network databases which includes respective control information to forward data within a respective network domain, said each of respective virtual routers respectively ~~each~~ including at least one respective network interface for ~~a~~ the respective network domain;

providing respective subscriber records in an electronic memory that include respective information as to network domains to which respective subscriber end stations of respective subscribers ~~may~~ can access;

providing multiple respective sub-interface data structures in the electronic memory respectively associated with respective subscribers;

searching respective subscriber records to identify respective network domains that may be accessed by a respective subscriber end station of a respective subscriber; and

creating respective binding data structures that respectively bind respective sub-interface data structures respectively associated with respective subscribers to respective network interfaces for respective network domains identified from searching respective subscriber records.

25. (Original) The method of claim 24 further including:

providing respective subscriber authentication information and respective subscriber authorization information in respective subscriber records;

providing subscriber authentication and authorization services; and

authenticating and authorizing subscriber access to respective network domains using respective subscriber records and the subscriber authentication and authorization services.

26. (Original) The method of claim 24 wherein,

the multiple respective sub-interface data structures include multiple respective virtual circuits.

27. (Original) The method of claim 24 further including:

providing in respective subscriber records multiple possible network domain binding options for a respective subscriber.

28. (Original) The method of claim 24 wherein,

information in respective subscriber records identify multiple respective possible network domains to which respective subscriber end stations of respective subscribers may be bound; and

information in respective subscriber records provide respective criteria for selecting between multiple respective network domains for a respective subscriber.

29. (Currently Amended) A subscriber management system comprising:

a network device including an electronic memory encoded with multiple respective virtual routers in the memory, each of said respective virtual routers including a separate ~~corresponding~~ respective network database~~s~~ which include~~s~~ respective control information to forward data within a respective network domain, said each of respective virtual routers respectively including at least one respective network interface to ~~a~~ the respective network domain;

respective subscriber records in an electronic memory that include respective information as to network domains to which respective subscriber end stations of respective subscribers ~~may be~~ are bound;

multiple respective sub-interface data structures in the electronic memory respectively associated with respective subscribers;

a computer program in electronic memory that searches respective subscriber records to identify respective network domains that may be accessed by respective subscriber ends stations of respective subscribers; and

respective binding data structures that respectively bind respective sub-interface data structures associated with respective subscribers to respective network interfaces to respective network domains identified from searching respective subscriber records.

30. (Original) The system of claim 29 wherein,

information in respective subscriber records identify multiple respective possible network domains to which respective subscriber end stations of respective subscribers may be bound; and

information in respective subscriber records provide respective criteria for selecting between multiple respective network domains for respective subscribers.

31. (Currently Amended) A network device comprising:

at least one processor;

memory;

I/O;

at least one virtual bridge in the memory, said at least one virtual bridge including a network interface, wherein the at least one virtual bridge is associated to an unique network domain, the at least one virtual bridge forwards data within the unique network

domain and the at least one virtual bridge is one of a plurality of virtual bridges in the memory;

a sub-interface data structure in the memory; and

a binding data structure in the memory which binds the network interface to the sub-interface data structure.

32. (Previously Presented) The network device of claim 31 wherein,

the network interface is a layer 2 network interface;

the sub-interface data structure is a layer 2 interface data structure; and

the binding data structure is layer 2/2 binding structure which binds the layer 2 network interface to the layer 2 interface data structure.

33. (Previously Presented) An apparatus comprising:

a single network device including,

a set of one or more processors;

a physical interface, the physical interface coupled to a network; and

a machine-readable medium having stored therein a set of instructions to cause the set of one or more processors to instantiate a first virtual router comprising a network interface and a first database, to instantiate a second virtual router comprising a network interface and a second database, and to bind with a data structure the first virtual router network interface to the first physical interface, wherein the first virtual router routes packets according to the first database within a first network domain through the

first virtual router network interface and the first physical interface, and wherein the second virtual router routes packets according to the second database within a second network domain.

34. (Previously Presented) The apparatus of claim 33, further comprising:

a second physical interface, the second physical interface coupled to the network, wherein the set of instructions further causes the single network device to bind with another data structure the second virtual router network interface to the second physical interface, and wherein the second virtual router routes packets through the second virtual router network interface and the second physical interface.

35. (Previously Presented) An apparatus comprising:

a single network device including,

a set of one or more processors; and

a machine-readable medium having stored therein a set of instructions to cause the set of one or more processors to instantiate a first virtual router comprising a network interface and a first database, to instantiate a second virtual router comprising a network interface and a second database, and to bind with a data structure the first virtual router network interface to a first virtual circuit, wherein the first virtual router routes packets according to the first database within a first network domain through the first virtual router network interface and the first virtual circuit, and wherein the second virtual router routes packets according to the second database within a second network domain.

36. (Previously Presented) The apparatus of claim 35, further comprising:

a second virtual circuit, the second virtual circuit coupled to the network, wherein the set of instructions further causes the single network device to bind with another data structure the second virtual router network interface to the second virtual circuit, and wherein the second virtual router routes packets through the second virtual router network interface and the second virtual circuit.

37. (Previously Presented) An apparatus comprising:

a single network device including,

a set of one or more processors; and

a machine-readable medium having stored therein a set of instructions to cause the single network device to instantiate a first virtual bridge comprising a network interface and a first database, to instantiate a second virtual bridge comprising a network interface and a second database, and to bind with a data structure the first virtual bridge network interface to a first virtual circuit, wherein the first virtual bridge switches packets according to the first database within a first network domain through the first virtual bridge network interface and the first virtual circuit, and wherein the second virtual bridge switches packets according to the second database within a second network domain.

38. (Previously Presented) The apparatus of claim 37, further comprising:

a second virtual circuit, the second virtual circuit coupled to the network, wherein the set of instructions further causes the single network device to bind with another data structure the second virtual bridge network interface to the second virtual circuit, and wherein the second virtual bridge switches packets through the second virtual bridge network interface and the second virtual circuit.

39. (Currently Amended) An apparatus comprising:

a single network device including,

a set of one or more processors;

a first plurality of ports to communicate packets of a plurality of subscribers;

a second plurality of ports to communicate packets; and

a machine-readable medium having stored therein a set of instructions to cause the set of processors to,

instantiate a plurality of virtual network machines, wherein the plurality of virtual network machines are virtually independent but share a set of physical resources within the single network device, wherein each of the plurality of virtual network machines is one of a virtual router and a virtual bridge, and wherein each of the plurality of virtual network machines belong to a different network domain,

receive subscriber records associated with the plurality of subscribers, wherein each of the plurality of subscribers are associated

with a virtual circuit on one of the first plurality of ports, wherein each of the first and second plurality of ports is associated with one or more sub-interfaces, and wherein each of the virtual circuits is associated with one of the sub-interfaces associated with the one of the first plurality of ports that the virtual circuit is on, and

dynamically bind a set of one or more network interfaces of each of the virtual network machines to a set of one or more of the sub-interfaces, such that each of the virtual circuits is communicatively coupled with one of said plurality of virtual network machines based on the subscriber record of the subscriber associated with that virtual circuit and such that at least some of the virtual network machines are communicatively coupled to one of the second plurality of ports, wherein the bindings are represented with a plurality of data structures.

40. (Previously Presented) The apparatus of claim 39, wherein the set of instructions further causes the set of processors to retrieve the subscriber records from a server that runs authentication, authorization, and accounting protocols.

41. (Previously Presented) The apparatus of claim 39, wherein the set of instructions further causes the set of processors to change the binding of one of the virtual circuits to a different one of said plurality of virtual network machines, wherein the binding change is based on the subscriber's subscriber record.

42. (Previously Presented) The apparatus of claim 41, wherein the binding change is based on time of day.

43. (Previously Presented) The apparatus of claim 39, wherein the set of instructions further causes the set of processors to,

bind one of the network interfaces associated with a first of the plurality of virtual network machines to a sub-interface for a first virtual circuit associated with a first port of one of the first and second plurality of ports, and

bind one of the network interfaces associated with a second of the plurality of virtual network machines to a sub-interface for a second virtual circuit associated with the first port.

44. (Previously Presented) The apparatus of claim 39, wherein the set of instructions further causes the set of processors to,

bind one of the network interfaces associated with a first of the plurality of virtual network machines to a sub-interface for a first virtual circuit associated with a first port of one of the first and second plurality of ports, and

bind another one of the network interfaces associated with the first of the plurality of virtual network machines to a sub-interface for a second virtual circuit associated with the first port.

45. (Previously Presented) The apparatus of claim 39, wherein the set of instructions further causes the set of processors to forward, within the network domains to which the virtual network machines belong, packets received over the virtual circuits communicatively coupled with the virtual network machines out the second plurality of ports.

46. (Previously Presented) The apparatus of claim 45, wherein the second plurality of ports is communicatively coupled to different ones of service providers and different virtual network machines have access to the different ones of the service providers.

47. (Previously Presented) An apparatus comprising:

a single network device including,

a set of one or more processors;

a plurality of ports to communicate a plurality of independent information flows of packets through the single network device between a plurality of end stations; and

a machine-readable medium having stored therein a set of instructions to cause the set of processors to,

instantiate a plurality of virtual network machines to forward the plurality of information flows through the single network device, wherein the plurality of virtual network machines are virtually independent but share a set of physical resources within the single network device, wherein

each of the plurality of virtual network machines is one of a virtual router and a virtual bridge, wherein the plurality of virtual network machines belong to different network domains with accounting for different administrative authorities, wherein each of the virtual network machines include one or more network interfaces, and wherein each of the plurality of ports is associated with one or more sub-interface data structures, and

dynamically bind, with a plurality of binding data structures, the network interfaces of each of the virtual network machines to different ones of the sub-interface data structures to couple each of the plurality of information flows to a currently appropriate one of the plurality of virtual network machines based on current authorization of that information flow, and wherein the bindings are dynamic based on a change in the authorization of each of the plurality of information flows.

48. (Previously Presented) The apparatus of claim 47, wherein the set of instructions further causes the set of processors to receive records associated with a plurality of virtual circuits, and each of the virtual circuits is communicatively coupled with one of said plurality of virtual network machines based on the record associated with that virtual circuit.

49. (Previously Presented) The apparatus of claim 48, wherein the set of instructions further causes the set of processors to retrieve the records from a server that runs authentication, authorization, and accounting protocols.

50. (Previously Presented) The apparatus of claim 48, wherein the set of instructions further causes the set of processors to change the binding of one of the virtual circuits to a different one of said plurality of virtual network machines, wherein the binding change is based on the record associated with the virtual machine.

51. (Previously Presented) The apparatus of claim 47, wherein the binding change is based on time of day.

52. (Previously Presented) The apparatus of claim 47, wherein the set of instructions further causes the set of processors to,

bind one of the network interfaces associated with a first of the plurality of virtual network machines to a sub-interface data structure for a first virtual circuit associated with a first port of one of the plurality of ports, and

bind one of the network interfaces associated with a second of the plurality of virtual network machines to a sub-interface data structure for a second virtual circuit associated with the first port.

53. (Previously Presented) The apparatus of claim 47, wherein the set of instructions further causes the set of processors to,

bind one of the network interfaces associated with a first of the plurality of virtual network machines to a sub-interface data structure for a first virtual circuit associated with a first port of one of the plurality of ports, and

bind another one of the network interfaces associated with the first of the plurality of virtual network machines to a sub-interface data structure for a second virtual circuit associated with the first port.

54. (Previously Presented) The apparatus of claim 47, wherein the binding change for one of the plurality of information flows is based on change in service associated with the information flow.